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Age constraints from northwest Russia on the global accumulation of carbon during the Palaeoproterozoic Shunga event

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The Palaeoproterozoic Shunga event records significant organic-carbon accumulation in sediments correlated between the type-locality in northwest Russia's Onega Basin, the Francevillian series of Gabon, and Indian Palaeoproterozoic sections. The estimated burial of >25 x 10E +10 tonnes of C in the Shunga event is significant and hypotheses have suggested this accumulation as one causal mechanism to the large positive Lomagundi-Jatuli positive carbon isotope excursion (CIE) of marine carbonates. Conversely, is has been suggested that the Shunga event post-dates the termination (at c. 2060 Ma) of the Lomagundi-Jatuli CIE and the two are not overlapping in time. Discrimination between these competing theories requires precise and accurate chronologies for the stratigraphic successions hosting the proxy records. We present new age constraints from a combination of primary volcanic rocks and sedimentary units recording the Shunga event, from the well preserved Palaeoproterozoic sections in the Pechenga Greenstone Belt (Kola craton) and Onega Paleo Basin (Karelia craton) northwest Russia, to further elucidate the unresolved question of timing between the Shunga event and the Lomagundi-Jatuli CIE.

Carbon accumulations of the Shunga event are recorded in the Pilgujärvi Sedimentary Formation of the Pechenga Greenstone Belt. Felsic lava flows and pyroclastic rocks, and mafic pyroclastic rocks, in the Pilgujärvi Volcanic Formation overlying the Pilgujärvi sediments yield zircons with concordant U-Pb ages between c. 1970 and 1903 Ma. In the Pilgujärvi Sedimentary Formation detrital zircons yield a minimum age of c. 1922 Ma, equivalent to a minimum c. 1915 Ma age of detrital zircons in the underlying Kolosjoki Sedimentary Formation. Thrust over the main units of the Pechenga Greenstone Belt is a tectonic melange known as the South Pechenga Zone where zircons from an intermediate volcanic rock yield the first age from this zone at c. 1930 Ma. Samples from the Onega Basin are still being analysed with initial age constraints from primary pyroclastic rocks and sedimentary units indicating a minimum depositional age for the Zaonega Formation (that hosts the carbon accumulations of the Shunga event) at c. 1970 Ma (single zircon ID-TIMS).

Shunga event-bearing sediments in northwest Russia have deposition ages that are uniformly younger than the termination of the Lomagundi-Jatuli CIE at c. 2060 Ma. This must be considered also when correlating between Shunga event-bearing sediments in Africa, India, and elsewhere. The implications of the age constraints here presented affect hypotheses linking the burial of organic carbon during the Shunga event with the termination of the Lomagundi-Jatuli positive carbon isotope excursion.